TABLE A: SPTR SITE SELECTION ANALYSIS — LOCATION V. REQUIREMENTS TRADES

REQUIREMENT	ELEVATED DORM BLDG. 21	BIF BLDG. 85	SKY LAB BLDG. 9	COMMS/DOME BLDG. 2	ARO BLDG. 23	BLDG 61 SUBSTATION "B"	MAPO BLDG. 46	EMERGENCY GENERATOR BLDG. 64
SUGGESTED LOCATION	SECOND FLOOR DORM ROOM[1]	INFLATION ROOM	2ND FLOOR	COMM. BUILDING, REAR CORNER	2ND FLOOR (BSI SPACE OR LAB SPACE)	AVAILABLE SPACE ALONG WALL	AMANDA SPACE OR VIPER CONTROL ROOM	AVAILABLE SPACE
SITE LONGEVITY	**GOOD** BUILDING AVAILABLE UNTIL 2005	**POOR** BUILDING RELOCATION IN 3 YEARS	**GOOD** LOCATION AVAILABLE UNTIL 2006	**GOOD** LOCATION AVAILABLE UNTIL 2006	**MARGINAL** LAB SPACE SCHEDULED FOR FUTURE SCIENCE USE	**MARGINAL** CABLE OSP PLAN NEEDS ADDITIONAL SPACE	**MARGINAL** LAB SPACE SCHEDULED FOR FUTURE SCIENCE USE	**GOOD** LOCATON AVAILABLE UNTIL 2006
AZIMUTH BEARING TO DARK[2] SECTOR LABS (SPIREX) (LONGITUDE)	26.2° W	31.1° W	42.2° W (EST.)	41.2° W	68.2° W (MET. TWR)	N/A	N/A	20.0° W (EST.)
EMI IMPACT ON DARK SECTOR[3]	**NO** (ANY EFFECT ON SPASE-2 NEEDS TO BE VERIFIED)	**NO** (ANY EFFECT ON SPASE-2 NEEDS TO BE VERIFIED)	**YES** MAIN BEAM INTERSECTS MAPO	**YES** MAIN BEAM INTERSECTS MAPO	**YES** MAIN BEAM GRAISES MAPO	**YES** VIOLATES DARK SECTOR USAGE	**YES** VIOLATES DARK SECTOR USAGE	**NO**
MULTI-PATH REFLECTORS[4]	**NO**	**NO**	**YES** MAIN DOME, FUEL ARCH	**NO**	**NO**	**YES** PICO DRILLING	**TBD** (PICO DRILLING SUSPECTED)	**YES** FUEL TANKS; WIND TURBINE; AIRCRAFT
GROUND CLUTTER[5]	**NO**	**NO**	**NO**	**NO**	**NO**	**YES** PICO DRILLING	**TBD** (PICO DRILLING SUSPECTED)	**YES** AIRCRAFT
EMI/RFI COMPATIBILITY[6]	**YES**	**NO** POSSIBLE S-BAND IMPACTS WX BALLOON RADIO-THEODOLITE	**YES**	**YES**	**NO** NOAA INSTRUMENTS (MITIGATION POTENTIAL TBD)	**NO** MAGNETIC FIELD OF PWR XMFRS ON TWTS; CONTRAVENES DARK SECTOR	**NO** CONTRAVENES DARK SECTOR; VIPER IMPACT TBD	**YES** (WHEN GENSETS ARE OFF)

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RADHAZ[7]	**NO**	**YES** (SUMMER ONLY)	**NO**	**NO**	**NO**	**YES** (SUMMER ONLY)	**NO**	**YES** (SUMMER ONLY)
TELEPHONE AVAILABLE [8]	**YES**	**YES** (LIMITED)	**YES**	**YES**	**YES**	**YES**	**YES**	**NO** (LAN)
LAN AVAILABLE [9]	**MARGINAL** REQUIRES NEW PHYSICAL INTERCONNECT TO BACKBONE	**QUALIFIED YES** UNTERM. FIBER LINES IN PLACE FOR BACKBONE INTERCONNECT	**YES**	**YES**	**YES**	**QUALIFIED YES** NO PERFORMANCE PROBLEMS IF DARK SECTOR IS MAIN CLIENT	**QUALIFIED YES** UNTERM. FIBER IN PLACE; SAME COMMENT AS FOR MAPO	**NO** NO FIBER; UTP COPPER LIMITED
ELECTRICAL DISTRIBUTION[10]	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
ELECTRICAL FEEDER CAPACITY[11]	**YES**	**YES**	**NO**	**YES**	**YES**	**YES**	**NO**	**YES**
HVAC[12] — SUMMER	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**MARGINAL** (TEMP CONTROL)
HVAC — WINTER	**NO**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
MAN-RATED SPACE ENVIRONMENTAL QUALITY	**GOOD** (WITH HEATING OF ROOM)	**QUALIFIED GOOD** TEMP CONTROL MAY BE VARIABLE	**GOOD**	**GOOD**	**GOOD**	**QUALIFIED GOOD** TEMP CONTROL MAY BE VARIABLE	**GOOD**	**POOR** AIR BORNE [13]SOOT, GREASE CONTAMINAT., VARIABLE TEMP CONTROL
ANTENNA MOUNT[14]	**SIMPLE** (ROOF)	**MODERATE** (WALL)	**MODERATE** (WALL)	**COMPLEX** (DOME)	**MODERATE** (WALL)	**SIMPLE** (ROOF)	**MODERATE** (WALL - VIPER CONTROL CAB)	**COMPLEX** (REQUIRES TOWER TO OVERCOME RADHAZ, CLUTTER)
MAN-RATED ENVIRONMENT FOR HOFFMAN BOX[15]	**YES**	**YES**	**YES**	**NO**	**YES**	**YES**	**YES**	**YES**
RF SIGNAL LINE RUN LENGTH (ANTENNA FEED TO HOFFMAN BOX)[16]	**IN SPEC**	**IN SPEC**	**TBD**	**OUT OF SPEC**	**IN SPEC**	**IN SPEC**	**IN SPEC**	**IN SPEC**
RF SIGNAL LINE RUN LENGHT (HOFFMAN BOX TO RACKS) [17]	**IN SPEC**	**IN SPEC**	**TBD**	**TBD**	**IN SPEC**	**IN SPEC**	**TBD**	**15 FT**

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FLOOR SPACE [18]	**YES**	**YES** (INFLATION ROOM)	**NO** LABS; LOUNGE	**YES**	**YES** BSI UV LAB; FUTURE SCI SPACE	**MARGINAL** COMPLICATED PUTS KU SYSTEM AT RISK	**NO**	**NO**
NASA INSTALLATION COMPLEXITY[19]	**SIMPLE**	**MODERATE**	**MODERATE**	**COMPLEX**	**SIMPLE-MODERATE** KU WAVEGUIDE RUN	**SIMPLE**	**COMPLEX** KU WAVEGUIDE RUN	**SIMPLE**
FMC CONSTRUCTION COMPLEXITY[20]	**MODERATE**	**SIMPLE**	**SIMPLE-MODERATE**	**COMPLEX** (ANTENNA)	**SIMPLE**	**SIMPLE**	**SIMPLE**	**SIMPLE**
MAINTAINABILITY (ASA W/O)[21]	**EXCELLENT**	**FAIR** (DUE TO ANTENNA ACCESS)	**GOOD**	**POOR** (DUE TO HOFFMAN BOX)	**GOOD**	**POOR** (DUE TO CROWDING AND LAYOUT)	**POOR** (DUE TO CROWDING)	**POOR** (DUE TO CROWDING, ANTENNA ACCESS, AND ENVIRONMENT)
QUALIFIED SITE	**YES**	**MARGINAL**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
RANKING OF PREFERENCE (DESCENDING ORDER)	**1**	**2**						

[1] LOSS OF DORM ROOM SPACE CAN BE COMPENSATED WITH ADDITIONAL BERTHING IN NEW SUMMER CAMP CONFIGURATION. ANTICIPATED WINTER BERTHING REQUIREMENTS DISPLACED CAN BE ABSORBED BY PLANNED HYPERTAT WINTER MODULES. EMERGENCY SURVIVAL USE OF ELEVATED DORM REQUIRES SPTR EQUIPMENT BE SACRIFICED AND REMOVED.

[2] THE ANTENNA BEAM WIDTHS ARE: (A) S-BAND = 7.6° AND (B) Ku-BAND = 1.2°. TO AVOID MAIN BEAM OR FIRST SIDE LOBE ILLUMINATION OF THE CORE AREA OF DARK SECTOR (BUILDING COMPLEX WITH MOST EXPERIMENTS), THE LINE OF AZIMUTH FROM THE SPTR ANTENNA TO THE TDRS F1 SATELLITE AT 49° W LONGITUDE MUST AVOID CO-INCIDENCE WITH LINE OF AZIMUTH FROM THE ANTENNA TO THE DARK SECTOR CORE COMPLEX. SPIREX WAS USED AS A REFERENCE. A 5° AZIMUTH (LONGITUDE) MARGIN IS PRUDENT TO ALLOW FOR S-BAND HALF-BEAM WIDTH.

[3] SOUTH POLE SCIENCE USERS OF DARK SECTOR HAVE BEEN CANVASSED AND AGREE THAT IT IS UNDESIRABLE, POTENIALLY HARMFUL, TO ILLUMINATE THE CORE DARK SECTOR AREA WITH THE TRANSMISSIONS. SOUTH POLE SCIENCE USERS DO NOT WANT BEAM SPILLAGE INTO CENTRAL AREA.

[4] PRACTICAL OPERATING EXPERIENCE WITH GOES-3 (S-BAND UPLINK) HAS REVEALED THE PRESENCE OF UP-LINK MULTIPATH FROM LOCAL SOURCES AT POLE AS MEASURED IN THE SIGNAL QUALITY AT MALABAR. MULTIPATH IS ALSO AN OBSERVABLE PHENOMENON ON THE POLE RECEIVE SIGNAL AT L-BAND. CLOSE IN METALLIC OBJECTS AND BUILDINGS WILL POSE A RECEIVE MULTIPATH PROBLEM BY SCATTERING SATELLITE DOWNLINK ENERGY INTO THE ANTENNA. CLOSE IN METALIC OBJECTS SHOULD BE AVOIDED.

[5] GROUND CLUTTER COULD OBSCURE THE LINE OF SIGHT NEEDED TO THE HORIZON. TDRS F1 IS PREDICTED TO RISE TO ONLY 0.86° IN ELEVATION DURING THE EARLY MONTHS OF THE TRIALS. GROUND CLUTTER COULD ALSO BE A SOURCE OF MULTIPATH. CLOSE IN GROUND CLUTTER IS TO BE AVOIDED.

[6] THE SYSTEM MUST CO-EXIST ELECTROMAGNETICALLY WITH ITS SURROUNDINGS. IT CANNOT INTERFERE WITH SENSITIVE RECEIVING SYSTEMS OR OTHER ELECTRONIC SYSTEMS THAT MAY HAVE IMPLEMENTATION WEAKNESS THAT CAUSE STRAY ENERGY PICKUP WHICH ALTERS PERFORMANCE (IE, SENSORS WITH LOW LEVEL OUTPUTS). RF RECEIVING SYSTEMS WITH LNA'S IN THE VICINITY OF THE EMISSIONS OF THE SPTR SYSTEM MAY BE VULNERABLE TO INTERMOD OR GAIN SATURATION INTERERENCE. THE SPTR SYSTEM CANNOT BE HARMED BY THE LOCAL ENVIRONMENTAL FIELDS OR RADIO INTERFERENCE. HIGH STRENGTH MAGNETIC FIELDS IN THE CLOSE PROXIMITY OF THE TRAVELING WAVE TUBES MAY BE A PROBLEM. EM COMPATIBILITY MUST BE ENSURED.

[7] SAFETY TO PERSONNEL FROM RADIATION MUST BE ENSURED. EXPOSURE MUST FALL WITHIN CURRENT OSHA/IEEE SAFE EXPOSURE LIMITS (EXPOSURE DURATION, FREQUENCY DEPENDENT). PLACEMENT OF THE ANTENNAS SUCH THAT AREAS FREQUENTED BY STATION PERSONNEL, EXPECIALLY FOR EXTENDED DURATIONS, MUST BE AVOIDED WITHIN PRESCRIBED RANGES OF AREAS INTERSECTING THE BORESIGHT (MAIN BEAM). GREATEST CONCERN IS FOR ACTIVITY CLOSE-IN TO THE ANTENNAS, SINCE SMALL APERTURE SIZE WILL HAVE HIGH POWER DENSITYS (W/M^2)

[8] THE SYSTEM WILL REQUIRE CONNECTION TO THE SOUTH POLE COMPUTER LAN BACKBONE. TWO ETHERNET PORTS ARE REQUIRED. TELEPHONE SERVICE (ONE LINE) IS NEEDED TO ASSIST IN OPERATIONS AND TROUBLESHOOTING.

[9] ESTIMATES OF LAN NETWORK ARCHITECTURE DESIGN REQUIRE SPTR TO BE A SEPARATE SUBNET ON THE SOUTH POLE BACKBONE. IN ORDER TO KEEP LOCAL LAN TRAFFIC FROM HEAVY LOGISTICS DATABASE USAGE (MAPCON APPLICATION), A SEPARATE PHYSICAL HOMED BACKBONE EXTENSION IS RECOMMENDED. TO ADEQUATELY UTILIZE THE LINK CAPACITY OF THE S-BAND 1 MB/S LINK WITH WHITE SANDS, THE SPTR LAN SUBNET SHOULD OPERATE AT LEAST AT T1 RATES. THIS IMPLIES A GOOD ETHERNET CONNECTION OR A T1 RATE LOCAL SUBSCRIBER CIRCUIT. OPTIONS ARE EITHER USE OF HDSL/UTP-COPPER (E.G., PAIRGAIN) OR ETHERNET/FIBER-OPTICS. DIRECT HOMING TO THE SOUTH POLE MAIN ROUTERS IS NEEDED.

[10] THE SYSTEM NEEDS 120 VAC AT 35 AMPS (APPROX. 4.2 KVA). TWO 20A ELECTRICAL SERVICE CIRCUITS ARE ANTICIPATED.

[11] TOTAL ESTIMATED SYSTEM POWER REQUIREMENTS ARE 4.2 KVA (ASSUMED PF=1). ADDITIONAL ELECTRICAL POWER MAY BE REQUIRED FOR AUXILLIARY HEATING, DEPENDING ON SITE SELECTION. THE BUILDING SERVICE FEEDER MUST BE ABLE TO SUPPORT THE ADDED LOAD.

[12] THE SITE LOCATION MUST HANDLE THE WASTE HEAT PRODUCED (CIRCULATE WITHIN THE FACILITY, ETC.). ADDITIONAL SUPPLEMENTAL HEATING MAY BE REQUIRED. THE SYSTEM'S OPERATING THERMAL RANGE IS APPROX. 10 °C - 30 °C.

[13] INCREASED POWER DEMANDS DURING THE SUMMER SEASON IS EXPECTED TO REQUIRE OPERATIONS OF THE EMERGENCY POWER PLANT IN PARALLEL WITH THE MAIN POWER PLANT UNTIL THE COMPLETION OF THE NEW POWER PLANT, SCHEDULED FOR 2002. PART OF THE INCREASED POWER DEMAND WILL COME FROM THE NEW POWER PLANT AND GARAGE ARCH CONSTRUCTION. PROLONGED OPERATION OF THE EMERGENCY POWER PLANT WILL PRODUCE AN ENVIRONMENT UNSUITED TO THE HEALTH OF THE SPTR ELECTRONICS, BASED ON OBSERVATIONS OF CONTAMINATE FOULING OF COMPUTER EQUIPMENT LOCATED IN THE EXISTING MAIN POWER PLANT.

[14] THE ANTENNA MOUNT MUST BE FABRICATED IN THE U.S. TO TAKE ADVANTAGE OF MATERIALS AND FITTING THE ANTENNAS. THE ANTENNAS MUST BE MOUNTED IN A WAY SUCH THAT THEY ARE ACCESSIBLE FOR FOCUS ADJUSTMENTS AND AIMING FOR SATELLITE ACQUISITION. ONCE INSTALLED, THE ANTENNAS ARE LOCKED DOWN - THE LOCATION MUST BE KEPT UNDISTURBED FROM MISALIGNING POINTING. THE ANTENNAS MUST BE REACHABLE WITH POLE STATION HEAVY EQUIPMENT (CRANE, ETC.). THE MOUNT MUST MATE WITH THE UNDERLYING SUPPORT STRUCTURE AND MUST NOT COMPROMISE THE STRUCTURAL INTEGRITY OF THE BUILDING. WIND LOADING MUST BE ACCOUNTED FOR.

[15] TWO HOFFMAN BOX ENCLOSURES WILL HOUSE THE CRITICAL ELECTRONICS (LNA, DIPLEXER, S-BAND UP/DOWN CONVERTERS) THAT MUST BE WITHIN 10 FEET OF THE ANTENNA FEED POINTS. DISTANCE RESTRICTION IS REQUIRED TO SET SYSTEM SNR AND MINIMIZE UPLINK LOSSES, AS REQUIRED FOR PERFORMANCE MARGIN. THESE ENCLOSEURES MUST BE IN MAN-RATED (TEMPERATURE) AREAS; THE ELECTRONICS CANNOT BE OBTAINED TO OPERATE AT SOUTH POLE WINTER AMBIENTS, GIVEN THE PROJECT'S BUDGET AND TIME LINES. THEREFORE, THE ANTENNA WILL NEED TO BE WITHIN 10 FEET OF A MAN-RATED AREA. AN ALTERNATIVE IS TO INSTALL INSULATION, A HEATER, AND A THERMOSTAT (AC POWERED), BUT THIS REPRESENTS A RELIABILITY RISK.

[16] SEE PRIOR NOTE.

[17] MAXIMUM ELECTRICAL LENGHT CONSTRAINED BY Ku-BAND AT 50 FT. THE S-BAND SYSTEM WILL ROUTE IF SIGNALS (70 MHz) BETWEEN THE HOFFMAN BOX ENCLOSURES AND THE EQUIPMENT RACKS THAT ARE IN MAN-RATED SPACE. THE MAXIMUM DISTANCE IS EXPECTED TO BE ON THE ORDER OF 100-200 FEET. THE CABLE WILL PROBABLY BE LOW LOSS PFTE, SOLID DIELCTRIC, AND THUS WILL BE FLEXIBLE AND BENDABLE AT ROOM TEMPERATURES. THE Ku-BAND SYSTEM WILL REQUIRE THE USE OF ELIPTICAL WAVEGUIDE (SEMI-RIDGID) TO MINIMIZE SYSTEM LOSSES, WITH A BEND RADIUS OF 1-2 FEET. A MAXIMUM LENGTH OF 50 FEET HAS BEEN SPECIFIED BY THE SYSTEM LINK CALCULATIONS TO MAINTAIN SYSTEM FADE MARGINS. AN UNOBSTRUCTED PATH WILL BE REQUIRED FOR ROUTING THE WAVEGUIDE, AS THE BENDING RADIOUS WILL NOT PERMIT SHARP BENDS AND TURNS.

[18] THE SYSTEM WILL REQUIRE TWO 6 FT EIA EQUIPMENT RACKS THAT MUST BE IN CLOSE PROXIMITY TO EACH OTHER. EQUIPMENT IN BOTH RACKS MUST INTERCONNECT WITH CABLES. THE UNITS CANNOT BE SEPARATED BY ANY SUBSTANTIAL DISTANCE. RACK ACCESS SPACE WILL BE REQUIRED IN FRONT AND TO THE REAR OF THE RACKS FOR PERSONNEL (TESTING, REPAIR). THE RACK LOCATIONS MUST REMAIN FIXED (NOT MOBILE) DUE TO THE

Ku-BAND ELIPTICAL WAVEGUIDE INTERCONNECTION. TOTAL ESTMATED FLOOR SPACE IS 70 SQ. FT. (INCLUDED SPACE FOR TEST EQUIPMENT AND A UPS).

[19] PRESENT ESTIMATES FOR NASA INSTALLATION REQUIRES 3 PEOPLE FOR 3 WEEKS FOR THE TOTAL FIELD LIFE CYCLE (ARRIVE, CLIMATIZE, UNPACK, SET-UP, DE-BUG, TEST, COMMISSION, USER TRAINING, CLEAN-UP, DEPART). THIS IS BASED ON A SIMPLE, STRAIGHT-FORWARD EQUIPMENT INSTALLATION. COMPLICATIONS DUE TO ANTENNA MOUNTING (INSTALLATION, ACCESS FOR POINTING) AND Ku-BAND WAVEGUIDE INSTALLATION COULD SIGNIFICANTLY ADD TO PERSONNEL TIME ON SITE AND ADDS RISK TO THE SUCCESS OF THE EFFORT. 3 PEOPLE WITH 3 DISTINCT AND SPECIALIZED SKILLS (SYSTEMS/ PROJECT, SOFTWARE/NETWORK, RF SYSTEMS) ARE REQUIRED.

[20] TOTAL TIME TO INSTALL THE SYSTEM IS CONTINGENT UPON ACCESS TO HIGHLY CONSTRAINED SHARED SOUTH POLE STATION INSTITUTIONAL RESOUCES FROM THE FACILITIES, MAINTENANCE, AND CONSTRUCTION (FMC) GROUP. CARPENTRY, ELECTRICAL WIRING, CRANE OPERATIONS, ETC. WILL BE NEEDED. GREATER COMPLEXITY INTRODUCED BY SITE CONFIGURATION/LOCATION COULD LIKELY RESULT IN THE CONSUMPTION OF MORE FMC RESOURCES IN TERMS OF LABOR HOURS.

[21] ASA INFORMATION SYSTEMS WILL BE REQUIRED TO MAINTAIN THE SYSTEM DURING THE WINTER PERIOD. ASA HAS ONLY ONE WINTERING COMMUNICATIONS TECHNICIAN AND ONE NETWORKING TECHNICAN ALLOTTED FOR THE WINTER PERIOD. HIGHLY DISTRIBUTED SITE INSTALLATIONS OR COMPLICATED INSTALLATIONS THAT ARE NOT CONDUCIVE FOR EASE OF ACCESS AND INTERACTION AMONG ALL THE CONSTITUENT PARTS OF THE SYSTEM BY A SINGLE TECHNICIAN WILL SIGNIFICANTLY INCREASE THE LABOR-HOUR DEMANDS ON THE SERVICING TECHNICAN, INCREASE THE RISK OF TASK CONFLICTS WITH OTHER NEEDED WORK AND RESPONSIBILITIES, AND ADD RISK TO THE SUCCESS OF THE PROJECT. PRIOR EXPERIENCE WITH SIMILAR ISSUES WITH THE EXISTING GOES-3 EXPERIMENTAL COMM SYSTEM HAVE DEMONSTRATED THAT POOR SITE LOCATIONS BY SUSTAINING OPS STANDARDS HAVE A SIGNIFICANT IMPACT.